Space Weather Technical Forecast

Issued on Saturday, 29 January 2022 at 12:35 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance G1/Minor Geomagnetic Storm and slight chance R1 Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low through the last 24 hours, with four numbered sunspot regions on the visible disc. AR2936 remains the largest and most complex (Dkc/Beta), with a continued increase in growth and development in its intermediate spots. This region continues to produce minor C-class flares. AR2934 remains unchanged. AR2937 continues to weaken and remains as Bxo/Beta. AR2935 has shown minor growth, with a intermediate spot emerging. AR2938 in the northwest has faded into plage.

No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 has fluctuated between slightly elevated and elevated, ranging between 390-530 km/s. The density was predominantly at average levels, but reached above average levels between 29/0300UTC and 29/0900UTC, before declining back to average. The total field strength (IMF) Bt, was mostly weak to moderate, varying between 4-9nT. The north-south component, Bz, remained weak and variable ranging between +6nT and -8nT. Phi angle was generally positive (away from the Sun), but with some brief negative fluctuations. Geomagnetic Activity was Quiet (Kp1-2), with Active intervals to end the period (Kp4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), was at background to moderate levels, peaking at 490 pfu at 28/1930 UTC. The associated electron fluence was below the Active threshold (1e8 integrated flux), with 1.12e7 recorded at 29/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity has been Low, with the most recent C-class originating from AR2936 in the northeast quadrant. Low activity is expected to continue, with a chance of isolated M-class flares, these again most likely from AR2936.

Solar Wind / Geomagnetic Activity: A weak CME may brush Earth on day 2 (30 Jan), but confidence is low. A second, probably weaker, CME may impact Earth on day 3 (31 Jan), although this is considered to be lower confidence.There is the continued influence of a slight enhancement from CH47 through day 1 (29 Jan), with solar winds expected to be slightly elevated to elevated, likely peaking around 550km/s, before gradually easing to become background to slightly elevated levels through day 4 (01 Feb). Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) increasing occasionally Active (Kp 4) today, tomorrow and during day 3 (31 Jan) with a slight chance of G1/Minor Storm (Kp 5) intervals.

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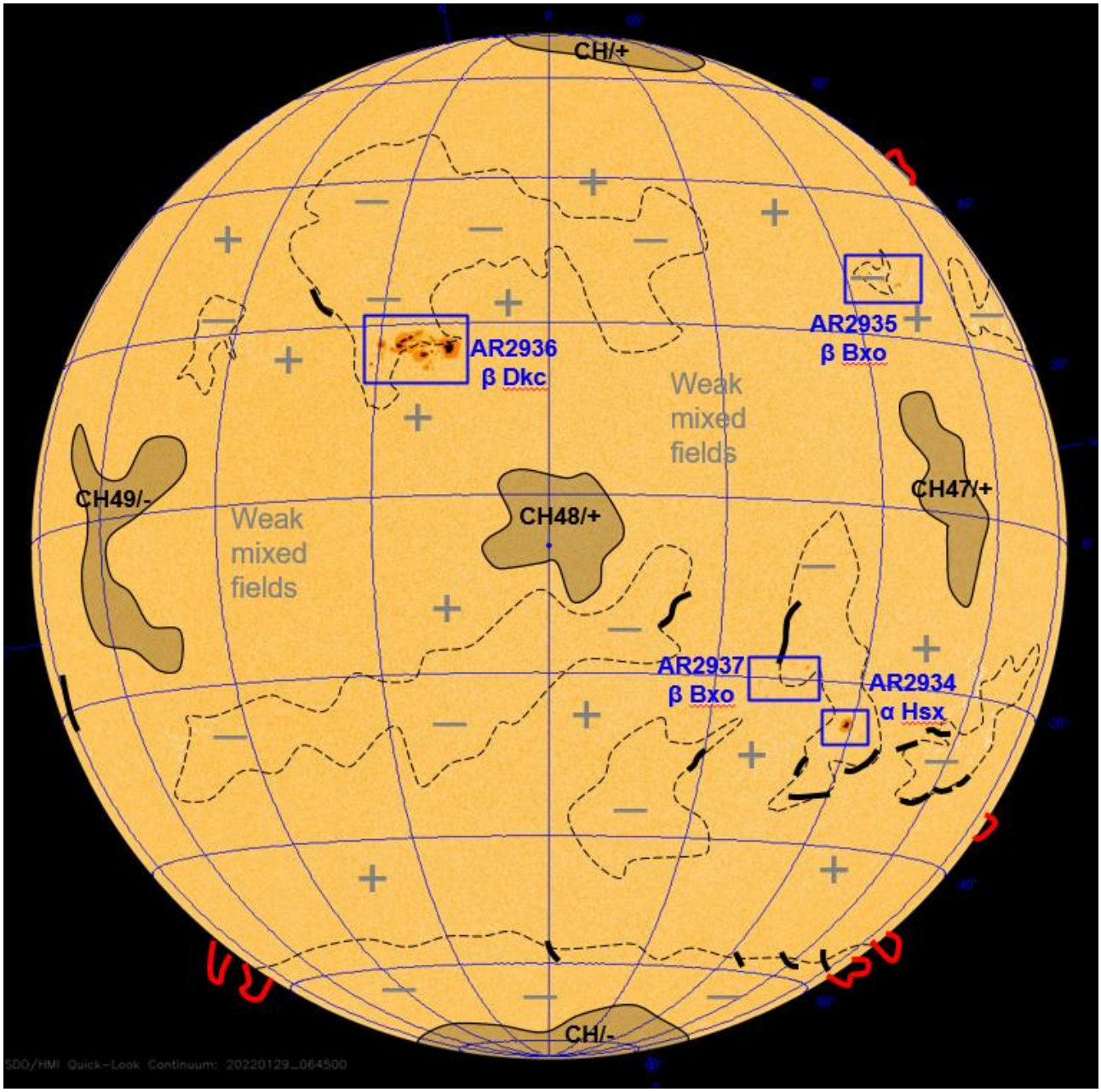
Met Office Space Weather Technical Forecast

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is forecast to remain at background levels. The high energy electron flux (greater than 2MeV) is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (31 Jan and 01 Feb). The associated 24hr fluence is expected to remain below the Active threshold, despite an increasing trend.

Figure 1. Solar Analysis Valid 29/0645UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption at 26/1945 UTC, from near AR2934 generated an Earth-bound CME which could give an Earth-directed glance on day 2 (30 Jan), although confidence is low. A second, probably weaker, CME may impact Earth on day 3 (31 Jan), although this is considered to be lower confidence.

Between the potential CME arrivals, solar winds are likely to remain slightly elevated for much of the period. This is in-line with expectations from persistence, and also timings of an enhancement seen in STEREO A PLASTIC data, although this is contaminated with a CME arrival.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) with a chance of further Active intervals (Kp 4) and a slight chance of G1/Minor Storm (Kp 5) intervals throughout, although probably more likely on days 2 and 3 (30 and 31 January).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	15	15	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/0501	Partial	Filament	S23 W12	411	30/1200UTC	Low confidence of any impacts

Figure 2: Met Office ENLIL Ensemble showing possible Earth-directed CME outcomes during the next few days.

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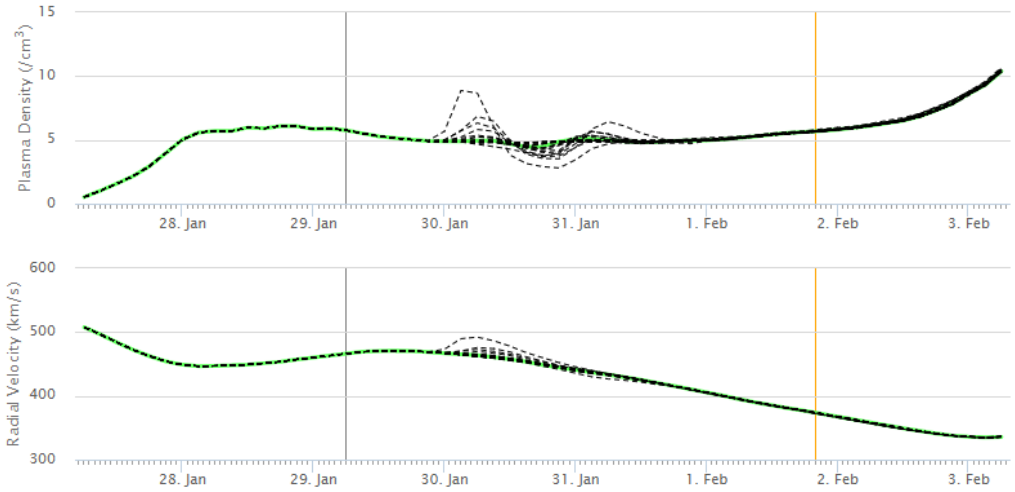
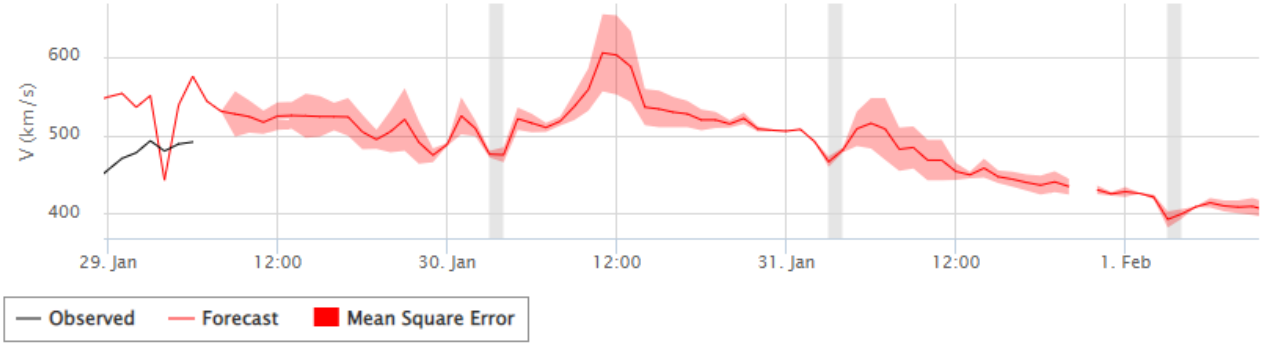


Figure 3: Met Office Solar Wind Prediction Model (SWPM) shows little change to the solar wind speeds during next few days, due to HSS from CH47.



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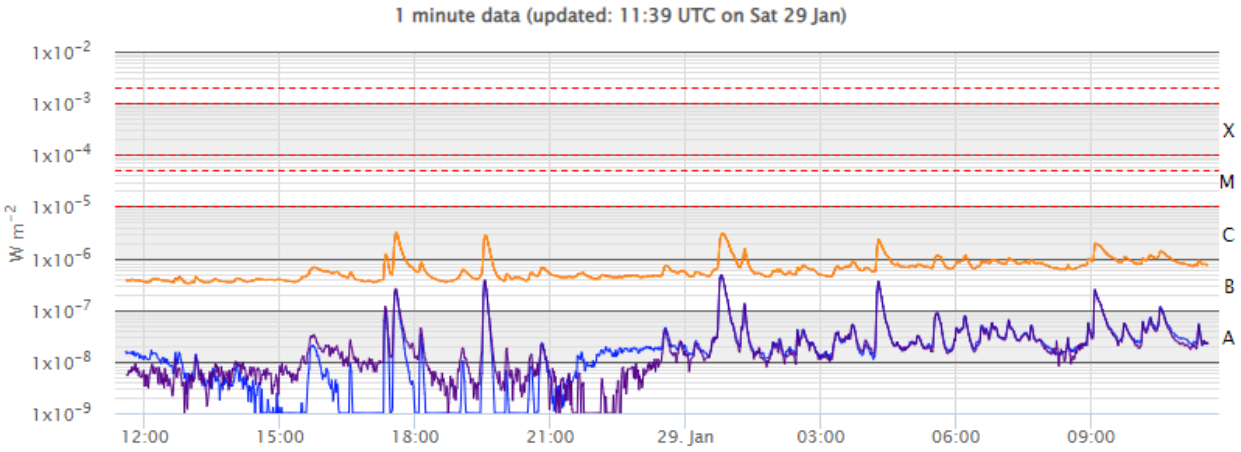
Radio Blackouts - X-Ray Flares:
Solar activity has been Low through the last 24 hours, with four numbered sunspot regions on the visible disc. AR2936 remains the largest and most complex (Dkc/Beta), with a continued increase in growth and development in the lead portion and a Delta configuration remains a possibility if some merging of intermediate spots were to take place. This region is continuing to be monitored for any potential delta configuration, which could further increase flare activity. AR2934 remains unchanged. AR2937 continues to weaken and remains as Bxo/Beta. AR2935 has exhibited some minor changes to both the leading spot and its trailer portion. Low solar activity is likely to continue for much of period, with a chance of isolated M-class flares, these most likely to be from AR2936.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 4: X-Ray Flux from GOES. Only minor C-class flares observed, mainly originating from AR2936.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. No solar radiation storms are likely in the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

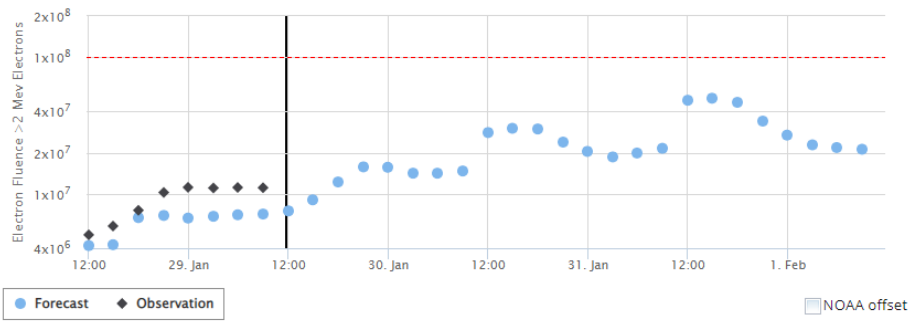
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as observed by GOES-16 at GEO, was at background to moderate levels, peaking at 490 pfu at 28/1930 UTC during the previous 24 hours. The high energy electron flux is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially towards the end of the four day period.

With only a limited flux response anticipated from either fast wind enhancement, the associated 24hr fluence is expected to remain below the Active (1e8 integrated pfu) level despite an increasing trend. The Met Office REFM output supports fluence levels remaining below the Active period, and this is considered to be good guidance at this stage.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	30	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: REFM observations and forecast.



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